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Future Research Plans

Our goal is to understand the properties of tensor categories of modules of non-rational vertex operator algebras through examples of triplet W-algebras and non-unitary Virasoro vertex operator superalgebras. In our previous work, we introduced a deformation technique for vertex operators and studied certain invariants called logarithmic couplings which are defined on the indecomposable Virasoro modules, and the structure of the projective modules of the triplet W-algebras [1, 2]. Moreover, this method is used to give a proof of the fusion rules for non-unitary Virasoro vertex operator superalgebras[4], which were conjectured in [3]. This deformation method is inspired by the theory of renormalization groups in physics, and is a new and unprecedented method in the theory of vertex operator algebras. We believe that this method can be applied to vertex operator algebras other than triplet W-algebras and non-unitary Virasoro vertex operator superalgebras. Our goal with this deformation technique is to achieve the following

- Determination of the structure of the fusion rules formed by the modules of the triplet W-algebra $\mathcal{W}_{p_+,p_-}$.
- Proof of rigidities of tensor categories of non-unitary Virasoro vertex operator superalgebras.

In our previous work[5], we gave a proof of certain non semisimple fusion rules for the triplet W-algebra $\mathcal{W}_{p_+,p_-}$ conjectured by Rasmussen [6] and Gaberdiel, Runkel, Wood [7], and derived a non semisimple fusion rings, but the structure of tensor products among all modules has not been determined. By using the deformation method of vertex operators, we can expect that the tensor product structure between modules will become clear. For non-unitary Virasoro vertex operator superalgebras, the tensor category is expected to be rigid[8]. By studying analytic properties of correlation functions formed by vertex operators using our deformation method, we expect to show rigidity of the tensor category.

References

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